bibliographic references and statements of habitat, and under each genus references to the published descriptions, if any are in existence, of the transformations of the species.

From the careful manner in which it has been prepared, this work cannot but be of the greatest service to future students of the Phytophaga, more especially if the author be enabled, as we trust he may, to finish the remaining (and far more difficult) portion of his task in the same style.

The Appendix consists of descriptions of new species (cited in their proper places in the catalogue) by the author and Mr. H. W. Bates, the latter describing those Amazonian species which were collected by himself. These descriptions are very numerous.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 21, 1866.—Lieut.-General Sabine, President, in the Chair.

"Observations on the Ovum of Osseous Fishes." By W. H. Ransom, M.D.

In this paper the author has communicated the details of observations of which the principal results were stated in a short paper published in the Proceedings of the Royal Society in 1854, and of further researches on the structure and properties of the egg in several species of osseous fishes. The methods employed in determining the functions of the micropyle, and in conducting the various inquiries entered upon, are described. The development of the ovarian ovum is traced in two species of *Gasterosteus*; and the yelk-sac is shown to increase by interstitial growth, and not by apposition of layers on either surface. A minute description of the germinal vesicle and its contents is given; and the germinal spots are shown to be drops of a thick fluid substance so apt to change their normally round form and to vacuolate in their interior, that no perfectly indifferent medium was found in which to examine them. The primitive yelk first formed around the germinal vesicle is shown to differ in some of its chemical and physical properties from that of the ripe ovum; it is solid, and does not consist of two distinguishable portions. On its surface a yelk-sac was found in very early ova, but in the smallest eggs examined it could not be separated.

The reactions of a variety of albumen allied to myosin, which the author has found in variable proportions in the yelk of all the fishes, amphibia, and birds which he has examined, are described, the yelk of the salmon being selected for experiment. This substance, to which the name albumen C is given provisionally, is remarkable, in addition to its being easily precipitable by water in excess, for forming under certain conditions a solution in dilute nitric acid not coagulable by boiling.

Some account is rendered of the reactions of an acid compound of

phosphoric acid with an organic substance also met with in the yelk of various animals.

The phenomena which follow impregnation prior to the commencement of cleavage are described, and are shown to be chiefly due to the influence upon the yelk of water which has passed through the yelk-sac.

Some variations which occur in this respect in different species of osseous fishes are described; and the ova of *Gasterosteus* are shown to be remarkable in having a viscid mucoid covering derived from the oviduct, which prevents the imbibition of water through the yelk-sac, so that it only enters and forms a breathing-chamber after impregnation, when it passes through the aperture in the apex of the micropyle; whereas in the eggs of salmon and in those of most other fishes, unimpregnated ova rapidly absorb water by the whole surface of the yelk-sac, the yelk contracting at the same time to form the breathing-chamber.

The concentration of the formative yelk, originally forming a thin layer over the whole yelk-ball, at the germinal pole is also proved to be due to the action of water, of which it requires a free supply sufficient to distend the yelk-sac, and to be independent of fecundation.

The contractions of the yelk are shown to be also independent of the action of the spermatozoids, and to be reactions following the entrance of water into the breathing-chamber—and this not only as regards the rhythmic waves which pass over the surface of the food-yelk, but also the fissile contractility of the formative yelk, by virtue of which it cleaves into irregular and unsymmetrical masses, and which the author conceives to be only regulated by the influence of the seminal particles.

The cortical layer of the food-yelk or inner sac, which is shown to resist in a remarkable manner osmosis, is found to be the rhythmically contractile part, although requiring for its manifestation the presence of acid food-yelk upon its inner surface.

Evidence is given to show that the contractile property of the yelk of both kinds requires, as an essential condition of its manifestation, the presence of oxygen in the surrounding medium, and that the food-yelk, while the rhythmic waves are passing over it, consumes less than does the formative yelk, while regularly cleaving after fecundation,—also that some product of oxidation is formed during these movements, which itself tends to check them, but which the author failed to determine the nature of.

Proofs are also given that a certain moderate rise of temperature increases the activity of these contractions. Experiments are related which show the extreme limits the yelk will bear without destroying them, and the temperature at which commencing chemical change prevents further contraction.

The reactions of the substance of the yelk under the stimulus of galvanism are recorded, and evidence afforded that the food-yelk and the cortical layer alone are excited to contraction by it, attempts made to induce fissile or other contractions of the formative yelk resulting in electrolysis of that highly unstable substance.

Experiments made to ascertain the effects produced by poisonous substances on the contractions of the yelk are recorded, and the general fact ascertained of the extreme indifference to such agents of yelk-protoplasm.

Carbonic acid, however, is shown to destroy the contractility rapidly, and chloroform to arrest it for a time.

The process of cleavage is described, and experiments are given which show that oxygen in the surrounding medium is an essential condition of its occurrence. The influence of heat in quickening it, and the comparative indifference which it shows to the action of a galvanic current and to most poisons, are proved by a series of experiments, in which also the remarkable and destructive activity of carbonic acid is evidenced.

The author has considered the egg as a cell, its contents as a protoplasm, of which the firmer cortical layer is the equivalent of the primordial utricle, and the fluid food-yelk of the liquid contents, while the formative yelk is represented by the granular accumulation around the nucleus. Two stages or grades of development of protoplasm are conceived to be represented by the two forms of yelk; and a parallelism is attempted to be drawn between them and the stages of development through which many amœboid organisms pass, and which the author believes to have a wide if not a universal existence in the organic world,—the lower grade, represented by the homogeneous food-yelk with a cortical layer and possessed of rhythmic contractility, passing into the higher, represented by the formative yelk, of a granular structure and possessed of a fissile contractile property only.

"On the Congelation of Animals." By John Davy, M.D., F.R.S. &c. Received since the end of the Session.

In a very interesting and elaborate paper by M. Puget, entitled "Sur la Congélation des Animaux," published in the Number of the 'Journal de l'Anatomie et de la Physiologie' for January and February of this year, he refers to a statement of mine, made many years ago*, that the leech may be frozen without loss of life. The experiments which he has instituted, and which appear to have been conducted with great care, have led him to an opposite conclusion—viz. that congelation is not only fatal to the leech, but to animals generally, without a single exception. He considers the cause of death (the *vera causa*, to use his own words) to be an altered condition of the blood. In consequence of this statement, I thought it right to repeat the experiments on the leech, and to extend them to some other animals. They were begun at Oxford in May, in the laboratory of Professor Rolleston, with the kind assistance of Mr. Edward Chapman and Mr. Robertson; and since then, in the following month, they have been continued at home in Westmoreland.

At Oxford the trials were made on leeches and frogs; at home, on these animals, and on the toad and some insects. The freezing-

* Researches Physiol. and Anat. ii. p. 121.

mixture was made of pounded ice and common salt; the temperature by it was commonly reduced to below 10° Fahr., or at times so low as 2° or 3°. The results obtained were briefly the following :—

1. A leech was exposed to the mixture in a small glass tube just large enough to hold it, using the tube for stirring the mixture. Taken out when perfectly rigid and hard, and gradually thawed, it showed when punctured a faint indication of irritability; there was a just perceptible contraction of the part punctured, the oral extremity, and nowhere else. It did not revive.

2. Another leech was similarly exposed, but for a shorter time. When divided by an incision, it was found not frozen throughout. When punctured, it showed marks of irritability in a slight degree stronger than the preceding: it soon died.

3. Two leeches were similarly treated at home, and for a somewhat longer time, the temperature reduced to 3°. These, when gradually thawed, one exposed to the air, the other left in the mixture, showed no marks of revival; but they retained a certain elasticity, so that when bent they shortly recovered their former attitude, after a manner somewhat resembling a vital movement; but inasmuch as they did not respond by the slightest contraction to puncture, it may be inferred that the movement was not vital. They resisted putrefaction for many days.

4. A frog in a thin glass vessel was kept in the mixture about a quarter of an hour. It was very rigid when taken out; thawed, no part, on puncture, afforded any indications of life; watched two or three hours, it proved to be dead.

5. The heart of a frog, removed immediately after decapitation, whilst still pulsating, was subjected to the freezing-mixture in a small glass tube. After having been frozen, on thawing it remained motionless, even when punctured. It had been kept in the mixture only a few minutes.

6. The inferior extremities of a frog kept extended by a bandage and thus introduced into a glass tube, were submerged in the mixture, the body of the frog being held in the warm hand; taken out after some minutes they were quite hard and motionless, whilst the body and upper extremities did not appear to be affected. It moved about, dragging the lower extremities as if they were dead. In about four hours it recovered the use of its femoral muscles, on the following day the use of the muscles of the legs; the day after, it was able to bend and extend these limbs; but there was no proof that its feet had recovered sensibility. On the fourth day it was found dead.

7. The lower extremities of a large toad were immersed in direct contact with the mixture, the temperature falling to 3°. Gradually thawed, the parts showed no marks of life. This toad, which before the trial was in a dull state, afterward became almost torpid, and so continued until the following morning, when it was apparently dead: opened, the auricles were found feebly acting, ceasing after a few seconds*.

* This toad was a female which had shed her ova; the oviduct was still large; the stomach was distended with caterpillars, slugs, &c., seeming to show that

8. A similar experiment was made on the lower extremities of an active frog, and with a similar result, except that the vivacity of the animal was for a short time but little impaired: after four hours it was apparently dead; opened, its auricles contracted when punctured. It may be right to mention that, before exposing the toad and frog to the freezing-mixture in direct contact, it was ascertained that the frog bore the immersion of its lower extremities in a saturated solution of common salt without any apparent loss of sensibility or motive power*.

9. The lower extremities of an active frog of a large size were wrapped in tin-foil, and, together with one of its upper extremities not so wrapped, were kept in a freezing-mixture about a quarter of an hour. The frozen parts in thawing showed no marks of life. The frog died in about three hours.

10. A cockroach, a flesh-fly, and a minute insect, an ichneumon † (*Cœlineus niger*?), confined together in a small glass tube, were kept some minutes in the mixture. Thawed, they were found all three dead.

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there was no diseased state. It is noteworthy that the apertures of the cutaneous glands appeared to be closed; for when the animal was irritated, there was no ejection of the acrid fluid, a circumstance I had before noticed in a female during the breeding-season, suggestive of a condition of surface favourable to the male in the generative act. When the tubercles were incised, they were found to contain the acrid fluid in plenty, and, judging from its bitter taste and the irritating effects of an extremely small portion applied to the tongue, not deficient in activity. The same state of the cuticular glands was found in another female toad killed by congelation, which had shed few of its ova,—this on the 23rd of June. It was of a lighter colour than usual. It was found likewise in two examined in July, in which some ova remained.

* The effect of immersion of the lower extremities of a frog in a saturated solution of common salt varies, I find, according to the length of time; if for a very few minutes, it is inconsiderable; if for many, it is well marked; and if much prolonged, it is fatal. In one instance, after a quarter of an hour's immersion, the limbs seemed paralyzed, the animal in a state approaching to torpor: after having been well washed in fresh water it slowly recovered its activity, and the limbs their motive power and sensibility,—their motive power first, their sensibility later—indeed not until the following morning, judging from the effects of puncture. After a longer immersion, with a fatal result, the limbs had become rigid and somewhat hard, especially the feet, as if their juices had been extracted by osmotic action. Opened after three hours, even the auricles were motionless, and this when punctured. The muscles of the limbs no longer showed a striated structure, whilst those of the upper extremities displayed this structure distinctly.

The toad, with a thicker skin, was found to bear the immersion of its extremities for a longer time; but the difference seemed to be only in degree; much longer continued, the same effects were produced, viz. rigidity, with loss of motion and sensibility, which (the immersion not being too long) were slowly recovered after freshwater ablution.

The blood-corpuscles, acted on by the same solution, underwent a change, contracting slightly, and acquiring a granular appearance, commencing in their nuclei.

† For the name of this insect I am indebted to Dr. Gray, F.R.S. It was selected on account of its minuteness: it weighed hardly $\frac{1}{100}$ of a grain; it seemed probable, on account of the minuteness of its vessels, that its fluids might escape congelation, after the manner of fluids in capillary tubes, which may be reduced many degrees in temperature without being frozen.

These results, so far as the particular instances are concerned, are sufficiently confirmatory of M. Puget's; and on my mind they leave little doubt that his general proposition (his inference from his very numerous experiments) is correct, that congelation is fatal to animal life. It is hardly worth while to attempt to account for the different conclusion I had come to (that referred to by him relative to the leech), it being partly founded on the fact that leeches which had been enveloped in ice for many days were not thereby killed, and partly on witnessing some marks of vitality in leeches which were believed to have been artificially frozen, and which very soon after died.

Whilst admitting that congelation, thorough congelation, of an animal is incompatible with life, the cause of death from congelation seems open to question, and more especially that assigned by M. Puget as the *vera causa*—a change in the blood, and chiefly in its corpuscles. That these corpuscles are changed by freezing in form and condition seems to be certain. Before seeing M. Puget's paper I had ascertained the fact, and not only that the corpuscles were changed, but also that the entire blood was to some extent altered, leading me at the time to ask whether some of the injurious effects of frost-bite may not be mainly owing to the freezing of the blood and the changes in consequence in the corpuscles and, in a less degree, in the fibrin *; and since, in examining the blood of the animals exposed to the freezing-mixture, I have had this confirmed; but the change in these instances was comparatively slight; even in those of the congealed limbs of the frogs and toad the majority of the corpuscles appeared little altered; some few seemed ruptured, some corrugated, and more contracted.

Judging from the effect of congelation on the heart of the frog in experiment No. 5, and from the effects of congelation partially produced, as in the extremities of the frog and toad, I would rather attribute the death to the freezing of the organs, not excluding the blood, than to the freezing of the blood alone; and I would ask, is not this view most in accordance with the pathology of the subject, with all that we know of frost-bite and its consequences in man, and with the results of Mr. Hunter's experiments on the local effects of congelation in animals—those on the ear of the rabbit and wattle of the cock†? and do not some even of M. Puget's results give it support, such as the opacity of the crystalline lens, he admitting that, were it possible for an animal to revive after complete congelation, it would be blind from cataract? Now, if the crystalline lens, if the blood-corpuscles suffer and undergo an appreciable change from congelation, it would be very remarkable indeed did not the brain and nerves, and the organs generally, suffer from the same cause, and experience changes incompatible with life. In the instance of man, we know that a certain reduction of his temperature

* Physiological Researches, 1863, p. 371. See also Trans. Royal Society of Edinburgh, 1865, vol. xxiv. p. 26.

† Phil. Trans. 1778, p. 34.

merely, not reaching to congelation, suffices to extinguish life *, and that in the instances of other animals, especially the hybernating and insects, a moderate reduction occasions torpor, ending in death if too prolonged. That the organs generally suffer from congelation M. Puget himself admits, as expressed in the subjoined paragraph†. I have found, too, that the muscles, after having been frozen, exhibit a marked change: thus, in one instance, that of a frog, in which, after decapitation, an upper and lower extremity were frozen, the muscles of these limbs, when thawed, compared with those which had not been frozen, showed a well-marked difference under the microscope; for whilst in the latter the striated structure was very distinct, in the former it was no longer visible; and after a few hours, viz. on the following morning, whilst the unfrozen muscles had undergone no perceptible alteration, those which had been frozen had become of increased tenderness, yielding to a slight rending force, and breaking short, as if the coherence of the particles forming the fasciculi had become greatly diminished.

MISCELLANEOUS.

On a Cranium of Ziphius *found at Arcachon* (*Gironde*).

By P. Fischer.

A magnificent cranium of a Cetacean, found in 1864 at Lanton, on the shores of the harbour of Arcachon, has been sent to M. Fillioux. The most superficial examination of this is sufficient to show that it belongs to an individual of the genus *Ziphius* of Cuvier.

If doubts have prevailed as to the origin of the *Ziphius* represented as fossil by the great anatomist (Ossem. Foss. tome v. 1re partie, pl. 27. fig. 3) from an imperfect specimen dug up at the mouth of the Galégeon (Bouches-du-Rhône), there can be none as to the cranium from Arcachon. Its perfect state of preservation, and the presence of fatty matters in its cerebral cavity, prove that the death of this Cetacean cannot even be very remote.

The length of the cranium, from the occipital foramen to the anterior extremity of the intermaxillary bones, is 89 centimetres; its breadth, from the orbital margin of the right frontal to that of the opposite side, is 48 centimetres; its height, from the base of the cranium to the upper margin of the nasal bones, is 41 centimetres.

The upper surface of the head is remarkable for the enormous development of the intermaxillaries, and their want of symmetry. In front they surround a very thick and prominent ivory-like tuberosity of the vomer; posteriorly they spread out, rise up and cir-

* Instances have occurred in the Lake District of persons who have perished on the hills from prolonged exposure to strong wind and rain, *storm-stricken*, in the language of the country.

† "... La congélation complète a même si profondément altéré les tissus de l'organisme que quand l'animal est tout-à-fait dégelé, son corps est flasque et mou, ses cristallins sont blancs et opaques, et souvent sa coloration est tout-à-fait altérée" (p. 24).